

ECM
TECHNOLOGIES

ICBP®: MODULAR INSTALLATIONS FOR HARDENING, VACUUM CARBURIZING AND VACUUM CARBONITRIDING

- ICBP® FLEX ■
- ICBP® MONO ■
- ICBP® DUO ■
- ICBP® JUMBO ■
- ICBP® NANO ■



Multi chamber- ICBP® Flex



Single chamber - ICBP® Mono



Double chamber - ICBP® Duo



Multi chamber- ICBP® Jumbo

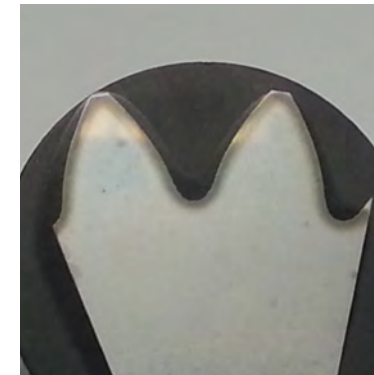


Multi chamber-ICBP® Nano

RESEARCH AND DEVELOPMENT

ECM Technologies invests about 10% of its revenue in R&D for the development of thermal processes with high added value and the creation of innovative furnaces and installations.

ECM Technologies' R&D department is a wide open structure which establishes partnerships with clients in order to qualify and validate the benefits of its solutions in their environment.



R&D METALLURGICAL LABORATORY

Processes available from our lab:

- Metallographic preparation for the samples
- Hardness (HRc, Hv) and micro-hardness (Hv)
- Microstructure investigation
- Carbon profile control
- Distortion measurements
- Sub-zero processing
- Complete reports for all customer testing

Our strong points:

- Testing on real industrial loads
- Our lab has a high level of reactivity
- Highly experienced metallurgists
- Improving treatment recipes



MORE THAN 1000 HEATING CELLS IN PRODUCTION WORLDWIDE

INFRACARB® MAIN CHARACTERISTICS

1 ENRICHMENT IN LOW PRESSURE CARBURIZING (LPC)

Dissociation reaction of a carburizing gas molecule under vacuum and temperature fact
With Acetylene :



2 CARBON Atoms
No Oxygen

DIFFUSION in LPC

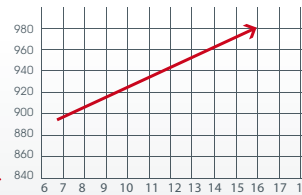
In LPC process, the diffusion of carbon under the surface is according to FICK law

2 CARBON FLUX

The quantity of carbon C is characterized by the increase of the weight of the test specimen compared to the surface and the time unit of carburizing

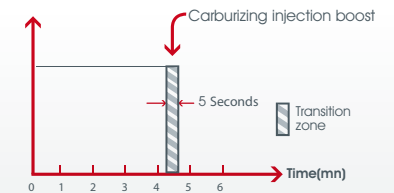
Enrichment flux
 $F = x \text{ mg/h.cm}^2$

Evolution of enrichment of the flux compared to temperature for a given steel material



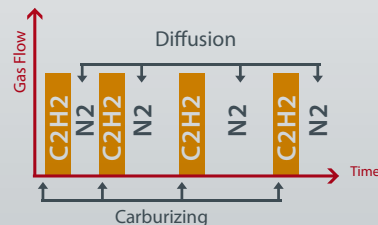
3 TRANSITION BETWEEN ATMOSPHERES

In LPC process, the shift from carburizing to diffusion sphere only takes 5 seconds



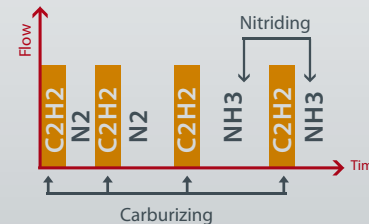
4 LOW PRESSURE CARBURIZING PROCESS

- Alternated injections C_2H_2 / N_2
- Constant working pressure during enrichment: range 5-20 mbar
- Temperature range: 880°C-1050°C



5 LOW PRESSURE CARBONITRIDING PROCESS (LPCN)

- Alternative injections of C_2H_2, N_2 and NH_3
- Temperature range: 880°C-960°C



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INFRACARB® ADVANTAGES COMPARED TO ATMOSPHERIC PROCESSES

- Better overall efficiency for gas reaction
- No inter-granular oxidation (IGO)
- Perfectly controlled and repeatable case depth with wlimited tolerances
- Better pitch to root consistency of case depth
- Ability to choose the surface carbon content load to load
- Green process: much less gaz consumption and no CO/CO₂ rejection
- Mixing of C₂H₂ with N₂ to adjust individual case to case penetrability
- Heat treatment time drastically reduced with higher process temperatures
- Excellent cosmetic aspect of the parts
- Enhanced fatigue strength with combination of low pressure carbonitriding and stop quenching®



MORE THAN 1000 HEATING CELLS IN PRODUCTION WORLDWIDE

The flexibility of our patented concept ICBP® enables both **gas quenching & oil quenching** for models Flex and Jumbo

GAS QUENCHING

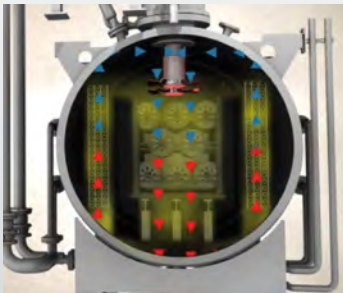
The high pressure gas quenching cell is a separate cell manufactured according to each country's certification. It is designed for adjustable cooling rate to reach the required hardness and to minimize distortions in a clean environment.

Quenching gas: nitrogen/helium/argon

Quenching parameters:

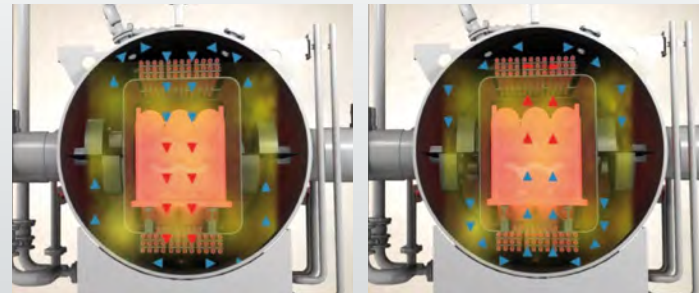
- Pressure, adjustable 1 to 20 bar abs
- Gas velocity, variable by VFD (speed of turbines)
- Step quench process for reduction of distortion
- Martempering process (stop quenching) for enhancement of mechanical properties

2 types of high pressure gas quenching cell are available:



■ Single gas flow quenching

The load is cooled from top to bottom, thanks to a vertical cooling turbine.
Very compact cell, limiting the gas consumption per cycle.



■ Reverse gas flow quenching

ALTERNATED GAS FLOW

Gas direction is variable - either from top to bottom or bottom to top thanks to horizontal cooling turbines. The shift of gas direction is achieved within 1 second, thanks to an ingenious system of lateral dampers actuated by cylinders.

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The flexibility of our patented concept ICBP® enables both **gas quenching & oil quenching** for models Flex and Jumbo

OIL QUENCHING



In case of low hardenability material, an oil quenching device should be considered. ECM Technologies provides the solutions.

The oil quenching cell is vertical, vacuum tight, and comprises 3 positions: loading / unloading, draining, and immersion. The oil direction is from bottom to top, through immersed hydraulic motors with variable speed drives. The cell works under partial nitrogen pressure, thus ensuring the absence of oxidation on the surface of the parts.

The oil cooling is ensured by a continuous water / oil or air / oil heat exchanger group depending on the operating temperature. 2 versions with different temperature ranges:

- **Cold oil version:** 60°C to 100°C
- **Hot oil version:** 110°C to 180°C

Gas cooling above oil, for parts going to intermediate machining before final hardening.



ECM TECHNOLOGIES

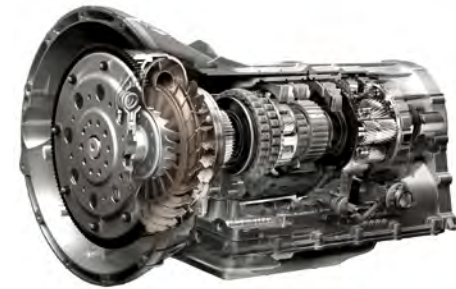
has developed a complete range of modular line systems to accommodate different applications.



STEERING



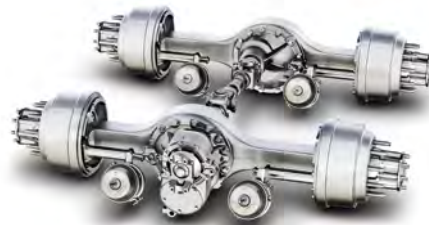
GEARS BOXES



TRANSMISSIONS



COMMON RAIL SYSTEMS CRS



AXLES



GEARS SHAFTS

And many others...

OUR REFERENCES*



*Non exhaustive list

CUSTOMERS' TESTIMONIES

Heat Treatment Process Development Manager in Delphi's Barcelona plant :

"The main reason for this choice is the cost"

"Their R&D team was always available, right from the preliminary design stage travelling to Barcelona several times without hesitation in order to advise us and discuss certain points. We highly value this availability and consider it to be one of ECM's distinctive assets."

Maintenance Manager at SEW-USOCOME :

"ECM looks through the eyes of its customer and does everything possible to minimize production losses. Suppliers providing a service like this can be counted on the fingers of one hand!"

Bodycote's low-pressuring carburizing development Manager for North America :

"During the tendering stage, ECM's ICBP technology clearly demonstrated its capacity to provide a proven technical solution in line with GM's specification... Its modularity, market proven reliability and relative ease of installation did the rest! "

General Manager of MTS :

"ECM has supplied a very interesting tool. We are adding our expertise in carburizing cycles for each of our numerous parts. It's then up to us to play our role as advisor to our customers."

Heat treatment maintenance at GETRAG Italy :

"These machines are at the core of our production system. Thanks to them, we have successfully completed numerous projects, treated dozens of different types of components with just as many case-hardening formulas, and produced up to 500,000 gearboxes per year... and all this with a minimum of equipment changes. This long service life is the major quality of the ICBP!

If we had to do it again? Even with hindsight, I wouldn't change a thing! I am very satisfied with the ICBP technology and I expressed this to my colleagues in the GETRAG Group that use another low-pressure carburizing technology."



ECM INSTALLATIONS



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